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AN 2000:412389 HCAPLUS
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 TI Extremely thin copper alloy wire having high strength and its
 manufacture
 IN Ichikawa, Masamitsu; Sawamoto, Takehito; Sugiyama, Shuichi
 PA Fujikura Ltd., Japan
 SO Jpn. Kokai Tokkyo Koho, 4 pp.
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AB	The extremely thin Cu alloy wire contains 0.05-2.0% Ag and has tensile strength .gtoreq.35 kg/mm2. A Cu-(0.05-2.0%)Ag alloy wire material is drawn at .gtoreq.50% draft and coated with an insulating material under heating at 200-400.degree..				

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(54)【発明の名称】 極細線及びその製造方法

(57)【要約】

【課題】 本発明は、引張強度が35kgf/mm²以上の高い強度を有するマグネットワイヤなどとして使用される極細線の製造方法を提供せんとするものである。

【解決手段】 かゝる本発明は、Ag濃度を0.05～2.0wt%とし、残部が銅及び不可避免的な不純物である銅合金線材に伸線加工率が50%以上の伸線加工を施し、しかる後、この伸線された銅合金線材に200～400℃の加熱下で絶縁材料を塗布し、焼き付ける極細線の製造方法にあり、このAg濃度とこの塗布し、焼き付け時の加熱温度によって、引張強度が35kgf/mm²以上の高い強度を有するマグネットワイヤなどとして使用される極細線が得られる。

【特許請求の範囲】

【請求項1】 Ag濃度を0.05～2.0wt%とし、残部がCuである銅合金線材からなることを特徴とする極細線。

【請求項2】 Ag濃度を0.05～2.0wt%とし、残部がCuである銅合金線材に伸線加工率が50%以上の伸線加工を施し、しかる後、この伸線された銅合金線材に200～400℃の加熱下で絶縁材料を塗布し、焼き付けることを特徴とする極細線の製造方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、電子機器などのマグネットワイヤなどとして使用される極細線及びその製造方法に関するものである。

【0002】

【従来の技術】近年電子機器の小型化、軽量化に伴い、これに使用されるマグネットワイヤ（巻線）も益々細径化が要求されている。しかし、線材の断面積が小さくなるほど線材の破断張力は小さくなる。このため、マグネットワイヤとして用いられる極細線、特に直径（φ）が0.1mm以下のものにあつては、高い引張強度を持つことが要求される。

【0003】通常、細径のマグネットワイヤとしては、銅線を所定のサイズまで伸線加工した後、種々の絶縁材料を高温で塗布し、焼付けて被覆させた合成エナメル線などが使用されている。

【0004】一方、銅線は（他の金属線も同様であるが）、伸線加工することにより、加工硬化し、高い引張強度を持つようになる。銅線を電線などの導体として使用する場合には、この伸線加工による特性を利用して、必要な引張強度を得るようにしていることが多い。

【0005】

【発明が解決しようとする課題】ところが、加工硬化された銅線は、約200～300℃の間の温度下におかれると、金属組織が再結晶化して、軟化する特性がある。

【0006】このため、上記のようにマグネットワイヤとして、銅線を用い、所定のサイズまで伸線加工しも、その後、絶縁材料を高温で塗布し、焼付けて合成エナメル線などとした場合、通常絶縁材料の塗布、焼き付けは200℃以上の高温で行う必要があり、この絶縁材料塗布時の高温処理によって、銅線が軟化してしまい、引張強度が低下してしまうという問題があった。

【0007】本発明は、このような従来の問題点に鑑みてなされたもので、線材の合金組成やその製造方法について種々の検討を行い、導体部の引張強度が35kgf/mm²以上の高い強度を有するマグネットワイヤ用などの極細線とその製造方法を提供せんとするものである。

【0008】

【課題を解決するための手段】請求項1記載の本発明

は、Ag濃度を0.05～2.0wt%とし、残部がCuである銅合金線材からなる極細線にある。

【0009】請求項2記載の本発明は、Ag濃度を0.05～2.0wt%とし、残部がCuである銅合金線材に伸線加工率が50%以上の伸線加工を施し、しかる後、この伸線された銅合金線材に200～400℃の加熱下で絶縁材料を塗布し、焼き付ける極細線の製造方法にある。

【0010】

10 【発明の実施の形態】本発明の極細線では、200℃以上の高温下で絶縁材料を塗布し、焼き付ける際の高温処理時における線材の軟化を防止するため、銅（Cu）にAgを添加して銅合金線材とし、そのAg濃度を0.05～2.0wt%としてある。なお、この銅合金線材中にはAgの他に通常工程中に除去しきれない微量の不純物（例えばSi、P、Feなど）が不可避的な不純物として含まれている。

【0011】ここで、Ag濃度を0.05～2.0wt%としたのは、Agの添加によって耐熱性が向上して引張強度が改善されるものの、0.05wt%未満では、35kgf/mm²以上の高い引張強度が得られなかったからであり、また2.0wt%を越えると、伸線性が悪化して極細線に伸線する際に断線し易いなどの問題が生じるようになるからである。

【0012】さらに、このようなAg濃度の銅合金線材を用いて、合成エナメルなどの絶縁材料を塗布し、焼き付けて、マグネットワイヤなどの極細線を製造する際には、この銅合金線材に伸線加工率が50%以上の伸線加工を施す。

30 【0013】この伸線加工は、必要により冷却手段を用いて、常温（25℃）程度の所謂冷間で行い、しかも、その伸線加工率は50%以上となるようにする。ここで、伸線加工率が50%以上ということは、伸線前の線材断面積が伸線後の伸びによって50%以下に減面される加工率のことをいう。この伸線加工率を50%以上としたのは、50%未満では加工硬化による引張強度の向上が小さく、不十分であるため、この値を50%以上とすることによって、伸線加工の段階で、先ず所定の引張強度の向上を図ったものである。

40 【0014】次に、この伸線された銅合金線材に200～400℃の加熱下で、合成エナメルなどの絶縁材料を塗布し、焼き付ける。これによって、目的とする導体部の引張強度が35kgf/mm²以上の高い強度を有する極細線が得られる。ここで、導体部の引張強度とは、合成エナメルなどの絶縁被覆層部分を剥離した状態における銅合金線材部分の引張強度をいう。

50 【0015】この塗布、焼き付け工程で、加熱温度を200～400℃の範囲としたのは、加熱温度が200℃未満では、温度が低過ぎて絶縁材料の線材表面への均一な塗布が確保し難くなるからである。また、逆に400

℃を越えて温度が高過ぎると、銅合金線材自体が軟化して引張強度が低下し、 35 kgf/mm^2 以上の高い引張強度が得られなくなるからである。

【0016】実施例

先ず、表1～2に示すように、それぞれA g 濃度の異なる直径8 mmの複数の荒引き銅合金線材（実施例1～5、比較例1～5）を連続鋳造装置で製造し、最終的に直径0.02 mmまで伸線した。この間途中の線径段階において300～400℃の温度で複数回の間焼鈍を行った。

【0017】そして、最終の間焼鈍の後、表1～2に示すような伸線加工率に従って、最後の伸線加工（直径0.05 mmから直径0.02 mmまでの伸線加工）を行い、次に、上記各銅合金線材を、線速150 m/min *

*nで走行させ、表1～2に示すような加熱温度下で、合成エナメル（ワニスなど）の絶縁材料を塗布し、焼付けて、各極細線を得た。

【0018】これらの各極細線について、導体部の引張強度と伸線性を測定し、その結果を、表1～2に併記した。ここで、引張強度は、絶縁被覆層部分を剥離した状態の銅合金線材部分を引張試験機にセットして行った。伸線性については、直径0.05 mmから直径0.02 mmまでの伸線を連続ストリップ伸線機で行い、その際の10 Kg 当たりの断線回数が10回以下のものを合格（○）とし、10回を越えるものを不合格（×）として評価した。

【0019】

【表1】

	実施例				
No.	1	2	3	4	5
A g 濃度 (wt %)	0.56	0.075	1.8	0.075	0.075
伸線加工率 (%)	99	99	99	99	56
塗布、焼付け温度 (℃)	250	250	250	380	380
引張強度 (Kgf/mm ²)	58	49	62	38	36
伸線性	○	○	○	○	○

【0020】

【表2】

	比較例				
No.	1	2	3	4	5
A g 濃度 (wt %)	0.03	2.2	0.56	0.56	0.0008
伸線加工率 (%)	99	99	99	47	99
塗布、焼付け温度 (℃)	250	250	450	250	250
引張強度 (Kgf/mm ²)	29	64	33	33	27
伸線性	○	×	○	○	○

【0021】上記表1から、本発明に係る極細線（実施例1～5）の場合、いずれも導体部の引張強度が 35 kgf/mm^2 以上で高い強度が得られると共に、伸線性についても、いずれもが合格（○）であった。

【0022】これに対して、A g 濃度（0.03 wt %）が本発明の条件より低過ぎる比較例1の場合には、焼付け後の導体部の引張強度が 29 kgf/mm^2 で

低かった。A g 濃度（2.2 wt %）が本発明の条件より高過ぎる比較例2の場合には、焼付け後の導体部の引張強度は 64 kgf/mm^2 で高いものの、伸線性が不合格（×）であった。塗布、焼付け時の温度（450℃）が本発明の条件より高過ぎる比較例3の場合には、焼付け後の導体部の引張強度が 33 kgf/mm^2 で低かった。伸線加工率（47%）が本発明の条件より小

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さ過ぎる比較例4の場合には、焼付け後の導体部の引張強度が33 kgf/mm² で低かった。Ag 濃度 (0.0008 wt %) が低過ぎてほぼ純銅に近い比較例5の場合にも、焼付け後の導体部の引張強度は27 kgf/mm² で低かった。

【0023】

【発明の効果】以上の説明から明らかなように、本発明

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に係る極細線及びその製造方法によれば、例えば直径が0.1 mm以下の極めて細い銅合金線材からなるものであって、かつ導体部の引張強度が35 kgf/mm² 以上の高い引張強度を有する優れた線材が得られる。これを、マグネットワイヤなどとして用いれば、電子機器の小型化、軽量化を大幅に促進することができる。

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(1)Application number : 10-346223

(71)Applicant : FUJIKURA LTD

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(72)Inventor : ICHIKAWA MASATERU
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1) EXTRA-THIN WIRE AND ITS PRODUCTION

Abstract:

PROBLEM TO BE SOLVED: To provide a method for producing an extra-thin wire having high strength of ≥ 35 kgf/mm² tensile strength and used as a magnet wire or the like.

SOLUTION: A copper alloy wire rod in which the concn. of Ag is controlled to 0.05 to 2.0 wt.%, and the pure copper with inevitable impurities is subjected to wire drawing at a wire drawing ratio of $\geq 50\%$, and, thereafter, this wire-drawn copper alloy wire rod is coated with an insulating material under heating at 200 to 300°C, which is baked. By this Ag concn. and heating temp. at the time of the coating and baking, an extra-thin wire having high strength of ≥ 35 kgf/mm² tensile strength and used as a magnet wire or the like can be produced.

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EXAMPLES

- Example(s)]
- Example 1] The extra fine wire which makes Ag concentration 0.05 - 2.0wt%, and is characterized by the bird clapper in the copper alloy wire rod whose remainder is Cu.
- Example 2] The manufacture method of the extra fine wire which Ag concentration is made into 0.05 - 2.0wt%, and the of wire drawing performs 50% or more of wire drawing to the copper alloy wire rod whose remainder is Cu, and uses an insulating material under 200-400-degree C heating at this copper alloy wire rod by which the wire drawing is carried out, and is characterized by printing after an appropriate time.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the extra fine wire used as magnet wires, such as electronic equipment, etc., and its manufacture method.

[0002]

[Description of the Prior Art] Narrow diameter-ization is increasingly demanded also for the magnet wire (coil) used for this with the miniaturization of electronic equipment, and lightweight-izing in recent years. However, the fracture tension of a wire rod becomes small, so that the cross section of a wire rod becomes small. For this reason, if the extra fine wire used as a magnet wire, especially a diameter (ϕ) are in a thing 0.1mm or less, it is required that it should have high tensile strength.

[0003] Usually, as a narrow diameter magnet wire, after carrying out wire drawing of the copper wire to predetermine size, the synthetic enameled wire which made various insulating materials apply, bake and cover with an elevated temperature is used.

[0004] on the other hand, the same of copper wire is said of a metal wire besides (--) and by carrying out wire drawing work hardening is carried out and it comes to have high tensile strength In using copper wire as conductors, such as an electric wire, it is making it obtain required tensile strength in many cases using the property by this wire drawing.

[0005]

[Problem(s) to be Solved by the Invention] However, also under the temperature between about 200-300 degrees C, a metal texture recrystallizes and the copper wire by which work hardening was carried out has the property to soften.

[0006] for this reason -- above -- as a magnet wire -- copper wire -- using -- up to predetermined size -- wire drawing -- also carrying out -- when an insulating material was applied and printed at an elevated temperature and it considered a a synthetic enameled wire etc. after that, usually, application of an insulating material and baking needed to be performed at the elevated temperature of 200 degrees C or more, copper wire became soft by high temperature processing at the time of this insulating material application, and there was a problem that tensile strength will fall

[0007] that by which this invention was made in view of such a conventional trouble -- it is -- alloy composition of a wire rod, and the various examination about the manufacture method -- carrying out -- a conductor -- the tensile strength of the section -- 35kgf/mm² the extra fine wire and its manufacture methods for [which has the above high intensity] magnet wires -- it is going to provide -- it is a thing

[0008]

[Means for Solving the Problem] this invention according to claim 1 makes Ag concentration 0.05 - 2.0wt%, and is in the extra fine wire which the remainder becomes from the copper alloy wire rod which is Cu.

[0009] Ag concentration is made into 0.05 - 2.0wt%, the rate of wire drawing performs 50% or more of wire drawing the copper alloy wire rod whose remainder is Cu, and this invention according to claim 2 is in the manufacture method of the extra fine wire which applies and prints an insulating material on this copper alloy wire rod by which the wire drawing was carried out under 200-400-degree C heating after an appropriate time.

[0010]

[Embodiments of the Invention] In the extra fine wire of this invention, in order to prevent softening of the wire rod at the time of high temperature processing at the time of applying and printing an insulating material under the elevated temperature of 200 degrees C or more, Ag is added in copper (Cu), it considers as a copper alloy wire rod, and the Ag concentration is made into 0.05 - 2.0wt%. In addition, in this copper alloy wire rod, the impurities (for example, Si, P, Fe, etc.) of the minute amount which cannot usually be removed in process besides Ag are contained as an unescapable impurity.

[0011] Here, less than [0.05wt%], it is 2 to have made Ag concentration into 0.05 - 2.0wt% 35 kgf/mm, although

nal resistance improves and tensile strength is improved by addition of Ag. It is because the above high tensile strength was not obtained, and is because the problem of being easy to disconnect in case wire drawing nature gets and a wire drawing is carried out to an extra fine wire will come to arise if 2.0wt(s)% is exceeded.

2] Furthermore, in case insulating materials, such as a synthetic enamel, are applied and printed using the copper wire rod of such Ag concentration and extra fine wires, such as a magnet wire, are manufactured, the rate of wire drawing performs 50% or more of wire drawing to this copper alloy wire rod.

3] This wire drawing is performed between the so-called colds about ordinary temperature (25 degrees C) using a drawing means as occasion demands, and it is made for the rate of wire drawing to become 50% or more moreover.

4] 50% or more says the thing of the working ratio by which the reduction of area of the wire rod end-face product of a wire drawing is made 50% or less by the elongation after a wire drawing in the rate of wire drawing. At less than 50%, having made this rate of wire drawing into 50% or more has the small improvement in the tensile strength by work hardening, and since it is inadequate, by making this value into 50% or more, it is the stage of wire drawing and aims at improvement in predetermined tensile strength first.

4] Next, insulating materials, such as a synthetic enamel, are applied and printed on this copper alloy wire rod by which the wire drawing was carried out under 200-400-degree C heating. the conductor made into the purpose by this -- tensile strength of the section -- 35kgf/mm² The extra fine wire which has the above high intensity is obtained. here conductor -- the tensile strength of the section means the tensile strength of the copper alloy wire rod portion in the where parts for a pre-insulation layer, such as a synthetic enamel, were exfoliated

5] Heating temperature was made into the range of 200-400 degrees C at this application and the baking process use heating temperature of temperature was too low at less than 200 degrees C and it was hard coming to secure a firm application on the wire rod front face of an insulating material. Moreover, conversely, exceeding 400 degrees when temperature is too high, the copper alloy wire rod itself becomes soft, tensile strength falls, and it is 2 35 nm. It is because the above high tensile strength is no longer obtained.

6] As shown in example point ** and Tables 1-2, two or more skimming copper alloy wire rods (examples 1-5, examples 1-5 of comparison) with a diameter of 8mm with which Ag concentration differs, respectively were manufactured with continuous casting equipment, and, finally the wire drawing was carried out to the diameter of 0.05mm. In the intermediate wire-size stage, intermediate annealing of multiple times was performed at the temperature 200-400 degrees C in the meantime.

7] And according to the rate of wire drawing as shown in Tables 1-2, the last wire drawing (wire drawing from the diameter of 0.05mm to the diameter of 0.02mm) was performed after the last intermediate annealing, next the insulating material of synthetic enamels (varnish etc.) was applied and baked under heating temperature as is run each pre-mentioned copper alloy wire rod by linear velocity 150 m/min and shows it in Tables 1-2, and each extra fine wire was obtained.

8] each of these extra fine wires -- a conductor -- the tensile strength and wire drawing nature of the section were measured, and the result was written together to Tables 1-2 Here, tensile strength set to the tension tester the copper wire rod portion in the state where a part for a pre-insulation layer was exfoliated, and performed it. About wire drawing nature, the wire drawing from the diameter of 0.05mm to the diameter of 0.02mm was performed by the insulation strip wire drawing machine, the number of times of an open circuit per 10kg in that case considered 10 or times of things as success (O), and the thing exceeding 10 times was evaluated as rejection (x).

9]

Table 1]

	実施例				
	1	2	3	4	5
濃度 (wt %)	0.56	0.075	1.8	0.075	0.075
加工率 (%)	99	99	99	99	56
焼付け温度 (℃)	250	250	250	380	380
強度 (Kgf/mm ²)	58	49	62	38	36
良率	○	○	○	○	○

020]
able 2]

	比較例				
	1	2	3	4	5
Ag濃度 (wt %)	0.03	2.2	0.56	0.56	0.0008
線加工率 (%)	99	99	99	47	99
布、焼付け温度 (℃)	250	250	450	250	250
張強度 (Kgf/mm ²)	29	64	33	33	27
線性	○	×	○	○	○

021] the case of the extra fine wire (examples 1-5) which starts this invention from the above-mentioned table 1 --
/ -- a conductor -- the tensile strength of the section -- 35kgf/mm2 while high intensity is obtained above -- wire
drawing nature -- any -- although -- it was success (O)
022] on the other hand -- the case of the example 1 of comparison which is too lower than the conditions of this
invention -- the conductor after printing -- the tensile strength of the section -- 29kgf/mm2 It was low. the case of the
example 2 of comparison which is too higher than the conditions of this invention -- the conductor after printing -- the
tensile strength of the section -- 64kgf/mm2 although it is high -- wire drawing nature -- a rejection -- it was (x) the
case of the example 3 of comparison which is too higher than the conditions of this invention -- the conductor after
printing -- the tensile strength of the section -- 33kgf/mm2 It was low. the case of the example 4 of comparison which
is too smaller than the conditions of this invention -- the conductor after printing -- the tensile strength of the section --
33kgf/mm2 It was low. Ag concentration (0.0008wt%) is low -- elapsing -- the case of the example 5 of comparison
is most near a pure copper -- the conductor after printing -- the tensile strength of the section -- 27kgf/mm2 It was low.
23]
Effect of the Invention] according to the extra fine wire which starts this invention so that clearly from the above
explanation, and its manufacture method -- a diameter -- the thing 0.1mm or less which consists of a narrow copper
wire rod extremely -- it is -- and a conductor -- the tensile strength of the section -- 35kgf/mm2 The outstanding
wire rod which has the above high tensile strength is obtained. If this is used as a magnet wire etc., the miniaturization
of electronic equipment and lightweight-ization can be promoted sharply.

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TECHNICAL FIELD

the technical field to which invention belongs] this invention relates to the extra fine wire used as magnet wires, such
electronic equipment, etc., and its manufacture method.

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PRIOR ART

[Description of the Prior Art] Narrow diameter-ization is increasingly demanded also for the magnet wire (coil) used with the miniaturization of electronic equipment, and lightweight-izing in recent years. However, the fracture of a wire rod becomes small, so that the cross section of a wire rod becomes small. For this reason, if the extra wire used as a magnet wire, especially a diameter (ϕ) are in a thing 0.1mm or less, it is required that it should have high tensile strength.

3] Usually, as a narrow diameter magnet wire, after carrying out wire drawing of the copper wire to predetermined diameter, the synthetic enameled wire which made various insulating materials apply, bake and cover with an elevated temperature is used.

4] on the other hand, the same of copper wire is said of a metal wire besides (--) and by carrying out wire drawing, hardening is carried out and it comes to have high tensile strength. In using copper wire as conductors, such as an electric wire, it is making it obtain required tensile strength in many cases using the property by this wire drawing.

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EFFECT OF THE INVENTION

Effect of the Invention] according to the extra fine wire which starts this invention so that clearly from the above explanation, and its manufacture method -- a diameter -- the thing 0.1mm or less which consists of a narrow copper alloy wire rod extremely -- it is -- and a conductor -- the tensile strength of the section -- 35kgf/mm² The outstanding wire rod which has the above high tensile strength is obtained. If this is used as a magnet wire etc., the miniaturization of electronic equipment and lightweight-ization can be promoted sharply.

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TECHNICAL PROBLEM

Problem(s) to be Solved by the Invention] However, also under the temperature between about 200-300 degrees C, a fine texture recrystallizes and the copper wire by which work hardening was carried out has the property to soften. [5] for this reason -- above -- as a magnet wire -- copper wire -- using -- up to predetermined size -- wire drawing -- carrying out -- when an insulating material was applied and printed at an elevated temperature and it considered as synthetic enameled wire etc. after that, usually, application of an insulating material and baking needed to be performed at the elevated temperature of 200 degrees C or more, copper wire became soft by high temperature pressing at the time of this insulating material application, and there was a problem that tensile strength will fall [7] that by which this invention was made in view of such a conventional trouble -- it is -- alloy composition of a rod, and the various examination about the manufacture method -- carrying out -- a conductor -- the tensile strength of the section -- 35kgf/mm² the extra fine wire and its manufacture methods for [which has the above high strength] magnet wires -- it is going to provide -- it is a thing

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EANS

Means for Solving the Problem] this invention according to claim 1 makes Ag concentration 0.05 - 2.0wt%, and is in an extra fine wire which the remainder becomes from the copper alloy wire rod which is Cu.

009] Ag concentration is made into 0.05 - 2.0wt%, the rate of wire drawing performs 50% or more of wire drawing to a copper alloy wire rod whose remainder is Cu, and this invention according to claim 2 is in the manufacture method of the extra fine wire which applies and prints an insulating material on this copper alloy wire rod by which the wire drawing was carried out under 200-400-degree C heating after an appropriate time.

010]

Embodiments of the Invention] In the extra fine wire of this invention, in order to prevent softening of the wire rod at a time of high temperature processing at the time of applying and printing an insulating material under the elevated temperature of 200 degrees C or more, Ag is added in copper (Cu), it considers as a copper alloy wire rod, and the Ag concentration is made into 0.05 - 2.0wt%. In addition, in this copper alloy wire rod, the impurities (for example, Si, P, S, etc.) of the minute amount which cannot usually be removed in process besides Ag are contained as an unescapable purity.

011] Here, less than [0.05wt%], it is 2 to have made Ag concentration into 0.05 - 2.0wt% 35 kgf/mm, although thermal resistance improves and tensile strength is improved by addition of Ag. It is because the above high tensile strength was not obtained, and is because the problem of being easy to disconnect in case wire drawing nature gets worse and a wire drawing is carried out to an extra fine wire will come to arise if 2.0wt(s)% is exceeded.

012] Furthermore, in case insulating materials, such as a synthetic enamel, are applied and printed using the copper alloy wire rod of such Ag concentration and extra fine wires, such as a magnet wire, are manufactured, the rate of wire drawing performs 50% or more of wire drawing to this copper alloy wire rod.

013] This wire drawing is performed between the so-called colds about ordinary temperature (25 degrees C) using a drawing means as occasion demands, and it is made for the rate of wire drawing to become 50% or more moreover. Here, 50% or more says the thing of the working ratio by which the reduction of area of the wire rod end-face product front of a wire drawing is made 50% or less by the elongation after a wire drawing in the rate of wire drawing. At less than 50%, having made this rate of wire drawing into 50% or more has the small improvement in the tensile strength by work hardening, and since it is inadequate, by making this value into 50% or more, it is the stage of wire drawing and aims at improvement in predetermined tensile strength first.

014] Next, insulating materials, such as a synthetic enamel, are applied and printed on this copper alloy wire rod by which the wire drawing was carried out under 200-400-degree C heating. the conductor made into the purpose by this -- a tensile strength of the section -- 35kgf/mm² The extra fine wire which has the above high intensity is obtained. here a conductor -- the tensile strength of the section means the tensile strength of the copper alloy wire rod portion in the state where parts for a pre-insulation layer, such as a synthetic enamel, were exfoliated

015] Heating temperature was made into the range of 200-400 degrees C at this application and the baking process cause heating temperature of temperature was too low at less than 200 degrees C and it was hard coming to secure a uniform application on the wire rod front face of an insulating material. Moreover, conversely, exceeding 400 degrees C when temperature is too high, the copper alloy wire rod itself becomes soft, tensile strength falls, and it is 2 35 kgf/mm. It is because the above high tensile strength is no longer obtained.

016] As shown in example point ** and Tables 1-2, two or more skimming copper alloy wire rods (examples 1-5, examples 1-5 of comparison) with a diameter of 8mm with which Ag concentration differs, respectively were manufactured with continuous casting equipment, and, finally the wire drawing was carried out to the diameter of 0.2mm. In the intermediate wire-size stage, intermediate annealing of multiple times was performed at the temperature of 300-400 degrees C in the meantime.

017] And according to the rate of wire drawing as shown in Tables 1-2, the last wire drawing (wire drawing from the

meter of 0.05mm to the diameter of 0.02mm) was performed after the last intermediate annealing, next the plating material of synthetic enamels (varnish etc.) was applied and baked under heating temperature as is run each above-mentioned copper alloy wire rod by linear velocity 150 m/min and shows it in Tables 1-2, and each extra fine wire was obtained.

[8] each of these extra fine wires -- a conductor -- the tensile strength and wire drawing nature of the section were measured, and the result was written together to Tables 1-2 Here, tensile strength set to the tension tester the copper wire rod portion in the state where a part for a pre-insulation layer was exfoliated, and performed it. About wire drawing nature, the wire drawing from the diameter of 0.05mm to the diameter of 0.02mm was performed by the wire drawing machine, the number of times of an open circuit per 10kg in that case considered 10 or more times of things as success (O), and the thing exceeding 10 times was evaluated as rejection (x).

[9]

Example 1]

	実施例				
	1	2	3	4	5
濃度 (wt %)	0.56	0.075	1.8	0.075	0.075
加工率 (%)	99	99	99	99	56
焼付け温度 (℃)	250	250	250	380	380
強度 (Kgf/mm ²)	58	49	62	38	36
性質	○	○	○	○	○

[10]

Example 2]

	比較例				
	1	2	3	4	5
濃度 (wt %)	0.03	2.2	0.56	0.56	0.0008
加工率 (%)	99	99	99	47	99
焼付け温度 (℃)	250	250	450	250	250
強度 (Kgf/mm ²)	29	64	33	33	27
性質	○	×	○	○	○

[21] the case of the extra fine wire (examples 1-5) which starts this invention from the above-mentioned table 1 -- a conductor -- the tensile strength of the section -- 35kgf/mm² while high intensity is obtained above -- wire drawing nature -- any -- although -- it was success (O)

[22] on the other hand -- the case of the example 1 of comparison which is too lower than the conditions of this invention -- the conductor after printing -- the tensile strength of the section -- 29kgf/mm² It was low. the case of the example 2 of comparison which is too higher than the conditions of this invention -- the conductor after printing -- the tensile strength of the section -- 64kgf/mm² although it is high -- wire drawing nature -- a rejection -- it was (x) the case of the example 3 of comparison which is too higher than the conditions of this invention -- the conductor after printing -- the tensile strength of the section -- 33kgf/mm² It was low. the case of the example 4 of comparison which is too smaller than the conditions of this invention -- the conductor after printing -- the tensile strength of the section -- 33kgf/mm² It was low. Ag concentration (0.0008wt%) is low -- elapsing -- the case of the example 5 of comparison

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ost near a pure copper -- the conductor after printing -- the tensile strength of the section -- 27kgf/mm² It was low.

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